ENEDIS
L'ELECTRICITE EN RESEAU

Electric vehicles and electricity distribution system

Conference of the European Electricity Markets Chair

Paris-Dauphine

17 octobre 2016

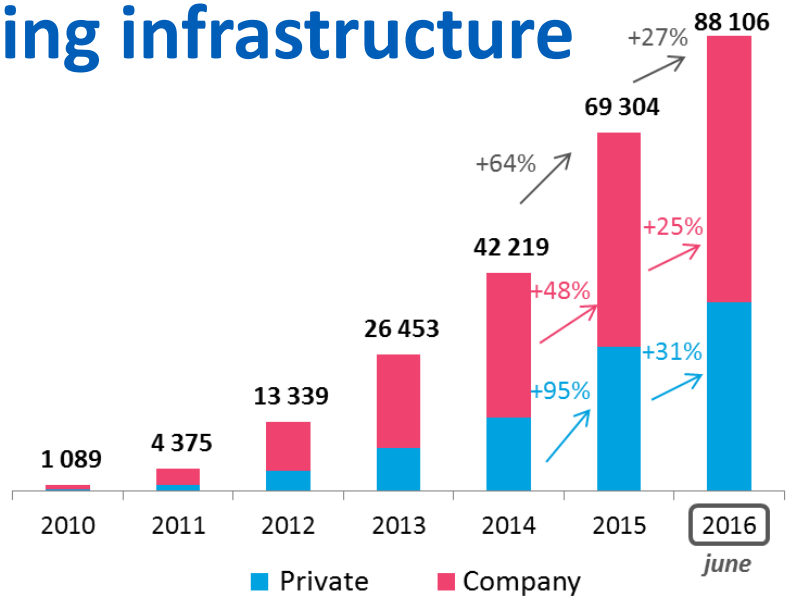
- [x] Libre
- [ ] Interne
- [ ] Restreinte
- [ ] Confidentielle

1. French EV market and charging infrastructure

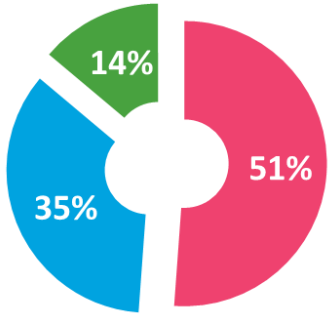
June 2016 : **88 106** electric vehicles (EV) and plug-in hybrids electric vehicles (PHEV) that represents 0.2% of the French cars fleet.

More than 85 % of the vehicles are fully electric.

A strong growth of the EV-PHEV fleet since 2010, including private owners.

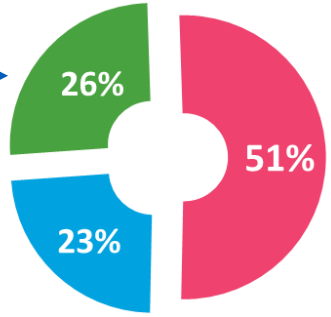


104 626 *charging points (June 2016)*



The average installed capacity of the public charging points is higher to cover the need of fast charging for long distance drive.

625 MVA *installed capacity (6 kVA per charge point)*



2. Quick and fast charging development

Charging points annual growth (june 2015 - june 2016)

Installed charging capacity is growing faster than the charging point number because of the development of quick charging points in the public area.

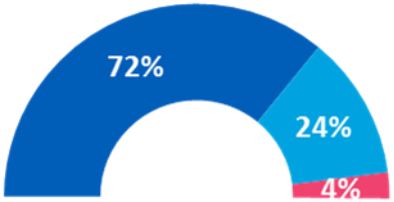
Number **+ 56 %**

Installed capacity **+ 62 %**

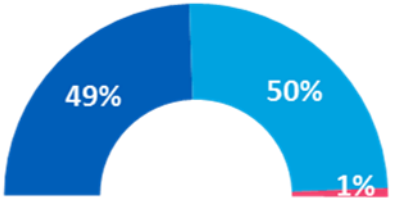
The number of public charging point should be increased almost **fourfold by 2020** (14 000 to 55 000). Installed capacity of the public charging points will grow even faster.

- Normal charging (up to 7.4 kW)
- Quick charging (22 kW)
- Fast charging (43 kW and more)

Public charging point by power type in june 2016



Public charging point by power type in 2019 (based on the identified projects)



3. Charging capacity and consequences

- **1 million EV** represents only **0.5% of total consumption**, simultaneous charging in "normal charge“. It calls for **3.5% of the installed capacity in France**.
- This 1 million EV simultaneously charging in "quicker charging" would represent a power demand of 22 GW or **22% of the total available power capacity**…
- … it would be over **40% for fast charging**.

This maximum risk approach help to understand what is at stake for installed capacity.

However more realistic assumptions have to be considered…

	DURÉE	APPEL DE PUISSANCE ÉLECTRIQUE
CHARGE NORMALE	**1 heure** de recharge pour 20 à 30 km d'autonomie récupérée **7 à 8 heures** pour une recharge totale	**de 3 à 7 kVA** équivalent à **un chauffe-eau**
CHARGE ACCÉLÉRÉE	**1 heure** pour une recharge totale soit 120 à 170 km d'autonomie	**22 kVA** équivalent à **20 machines à laver**
CHARGE RAPIDE	**30 minutes** pour une recharge totale	**43 kVA en courant alternatif 54 kVA en courant continu ou plus** équivalent à **un immeuble de 10 logements**
CHARGE ULTRA-RAPIDE (pour des véhicules spécifiques)	**30 minutes** pour récupérer 270 km	**120 kVA** équivalent à **deux immeubles de 10 logements**

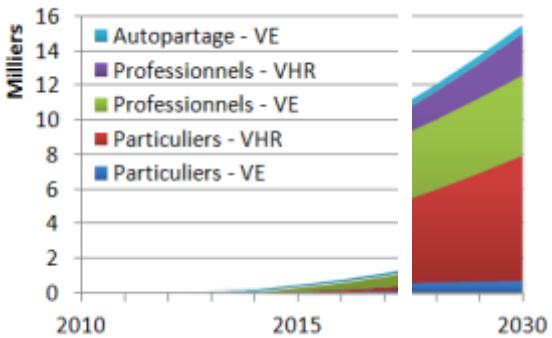
4. Forecasting and managing network impacts

1 - In the context of the **GreenLys project in Lyon**, Enedis has conducted a prospective study to evaluate potential impacts on the low voltage network :

- Development of a tool able to simulate the charge of a MV/LV substation taking into account EV recharges based on deployment scenarios to 2020 and 2030 horizon.
- Assesment of the impact of alternative solutions of Smart Charging.

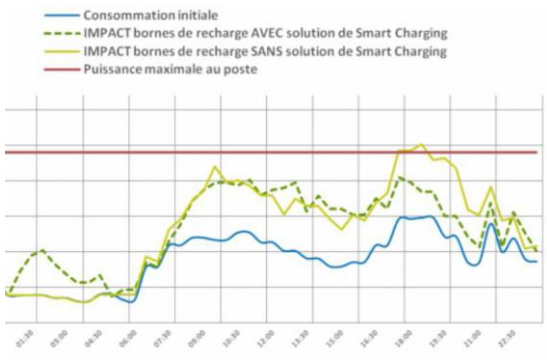
1

Local development scenarios of EV and PHEV on the Greenlys area of Lyon



2

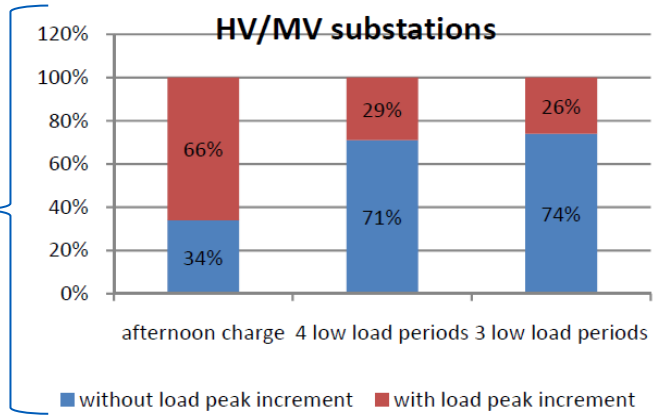
Modeling of EV recharges on the network



3 **Potential network constraints to year 2030**

23% of MV/LV substations in constraint **without** Smart Charging

16% of MV/LV substations in constraint **with** Smart Charging



2 – On a **national basis** Enedis has conducted a prospective study to evaluate potential impacts on the medium voltage network.

It demonstrate the value of charge regulation to limit the number of primary substation and MV feeders concerned by peak demand increases.

5. Synthesis of challenges

1. Development planning and location of charging stations

- The movement is started but the current **pace of deployment** of the charging station is not yet strong enough to reassure drivers.
- **Need to ensure interoperability** for the user of all charging infrastructure installed in the territory. Indeed, it is crucial to allow users not to be faced with the multitude of cards and badges in order to use either the private terminals or public charging stations.
- There must be a **national blueprint for the harmonious implementation of the charging stations** both regarding the type (slow, standard, fast or very fast) and their location (conceded highways, national highways, local roads...).

2. Development of Smart Charging

- The electric mobility will have no major impact on consumption but on peak demand; an ambitious scenario could have considerable impact if all electric vehicles recharge at the same time

  (i.e 7:00 PM – 8: 00 PM when driving back home).

  Therefore, **Enedis recommends charging mode to be remotely controlled** (smart charging).
- In the longer term, electric vehicles could become itself an electricity storage, in connection with the deployment of renewable energy.

3. Quality of electricity

- ENEDIS is studying the technical impact of charging on the grid (reinforcements, disruption on frequencies and harmonics) in order to master them to continue to ensure the quality of distributed electricity.

6-Enedis enable Nationwide projects

TESLA

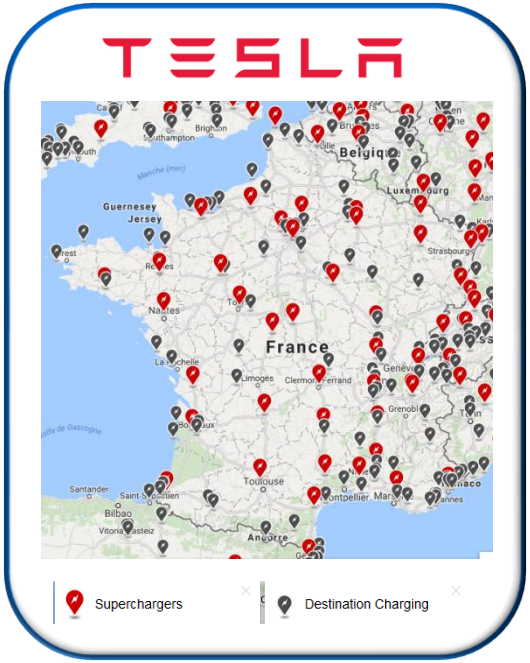
- **41 TESLA superchargers** in late august 2016, including 19 in MV .
- Perspective to double by end of 2017.
- At the same time, TESLA encourages hotels, malls, resorts or sights to be equipped with stations named “destination charging”.

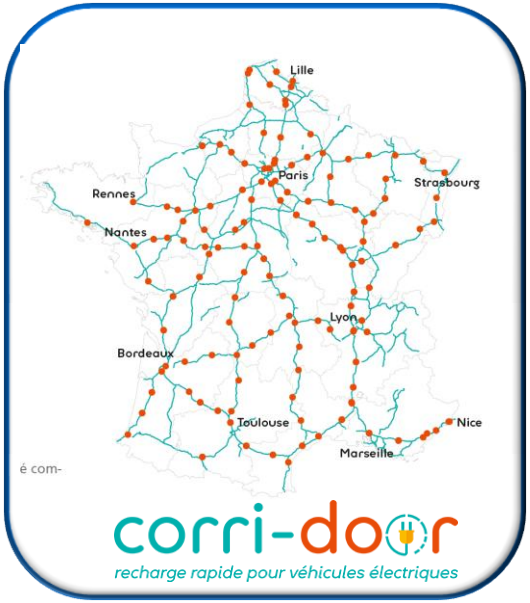
corri-door
recharge rapide pour véhicules électriques

- Developed by sodetrel GROUPE EDF, Corri-Door is a national network made up of **200 universal fast charge terminals** for electric vehicles. They are installed, every 80 km or so, all over France.
- The Corri-Door network of terminals enables all users to re-charge their electric vehicles in under 30 minutes. The terminals can use the four standards of plugs currently used on the market.

Bolloré

- A project of **16,000 charging points** to deploy by end 2019, spread on about 8,000 charging stations.
- In order to recharge all type of electric vehicle in a public space (parking, cinema, train station, shopping center, national road and downtown).





7 - Enedis enable electric mobility developement

- Enedis helps its customers (public authorities and companies) in their projects of electric mobility.
- Enedis use GPS location information to realize a study of impact on network development of a new charging point.
- Enedis coordinate multi connection requests.

Partnership on electric mobility

- Share the stakes around the electric mobility
- Exchange on the basic steps of a charging station project

Study of optimization for charging stations location

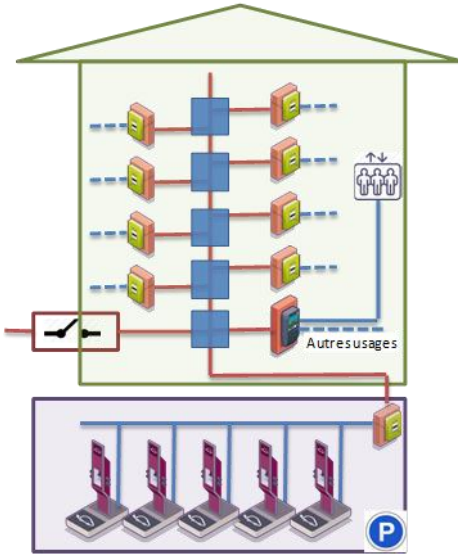
- Optimize implantation of charging station on the electric network
- Analyze the feasibility of connecting the charging station

Management charging stations multi-connection requests

- Coordinate the implementation of multiple connection
- Centralize the follow-up of the multi-connections projects

8. Enedis enable electric mobility development in existing collective building and company fleets

The residential housing being potentially one of the main locations for EV charging in urban areas, the project **BienVEnu** explores the feasibility of charging stations in existing collective building.

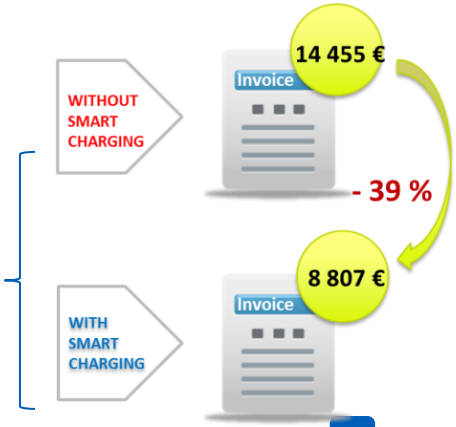


Designing a « smart » recharging system :

- An algorithm has been developed to manage EV charging, integrating the needs and user requirements. The system facilitates the insertion of EVs on the grid, by controlling the impact on the network and the subscribed power. And that results in an optimized infrastructure (and invoice!).
- As coordinator of the project, Enedis manages it and ensures the tasks progress as planned. Enedis is also in charge of the mains connection offer and will take into account specific cases and situations, paying close attention to the potential impact on the public distribution network.

With the project **Ecoflot**, Enedis initiated the conversion of a part of its fleet to electric vehicles, with a target of 2,000 electric vehicles, or nearly 15 % of its light vehicle fleet.

- The feedback has helped to highlight the importance of user support and management, and utility of the Smart charging.
- Implementation of intelligent charging control, management and reporting permitted to illustrate the avoided costs on a site Enedis with 37 EV.



9. What prices structure ?

Electric vehicles and charging points owners or users receive a range of economic signals from the DSO :

- network connection prices
- network use prices (tariffs)

Efficiency and consistency of these signals will enhance the integration of electric vehicles on local networks.

Connection prices : match local demand for charging points and local network least-cost capacity increase
➔ *schemes that define standard price / high price zones for new charging points in public space*

Tariff : prices for both energy received from the network and for maximum charging capacity guaranteed
Standard, fast or superfast charging makes clear that these are two increasingly different services: Same amount of energy received, but very different power guaranteed and network challenges
➔*Enedis believes that regulated tariffs should be rebalanced towards lower energy prices in off-constraint periods and higher price for power guarantee*

Beyond, **Enedis is considering test and prove smart charging** with smart contracts

Summary

To **support the deployment of the electric car**

- Ensure as soon as possible interoperability for users of all charging infrastructure installed in the territory by issuing the decree “IRVE”.
- Establish a **national director of charging infrastructure scheme** to ensure geographical coherence of the implementation of the terminals and the relevance of the chosen technologies (slow, standard, fast, fast or ultra-fast).
- Anticipate the impact (peak effects) of the deployment of electric vehicle on networks by setting up an **incentive tariff signal** and using smart technologies and communication associated.